

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>4</sup> : <b>B26D 1/14</b>		A1	(11) International Publication Number: <b>WO 89/04746</b> (43) International Publication Date: <b>1 June 1989 (01.06.89)</b>
<p>(21) International Application Number: <b>PCT/SE88/00594</b> (22) International Filing Date: <b>4 November 1988 (04.11.88)</b> (31) Priority Application Number: <b>8704617-3</b> (32) Priority Date: <b>23 November 1987 (23.11.87)</b> (33) Priority Country: <b>SE</b></p> <p>(71)(72) Applicants and Inventors: LARSSON, Ove [SE/SE]; Björруд 1090, S-661 00 Säffle (SE). LARSSON, Sten [SE/SE]; Pilgatan 4, S-661 00 Säffle (SE).</p> <p>(74) Agent: HYNELL, Magnus; Hynell Patentjänst AB, Box 236, S-683 02 Hagfors (SE).</p> <p>(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BG, BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH, CH (Euro- pean patent), CM (OAPI patent), DE, DE (Utility model), DE (European patent), DK,</p>		<p>FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.</p> <p><b>Published</b> <i>With international search report. In English translation (filed in Swedish).</i></p>	
(54) Title: <b>CIRCULAR SLITTING KNIFE</b>			
(57) Abstract			
<p>A circular slitting knife, particularly a circular slitting knife, which is designed to slit relatively soft plain or composite materials, such as textile, paper or plastic materials or the like materials. Said circular slitting knife is designed to work against a holding-on cylinder (15), possibly made of a plastic, rubber or comparable material. Said circular slitting knife has a thin circular slitting blade (1). On either side of said slitting blade rings (2, 3) or discs made of a rubber or a plastic material are mounted. Said rings or discs are pressed against said slitting blade by means of clamping devices, such as outer metal plates (4, 5) or the like.</p>			

BEST AVAILABLE COPY

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT Austria	FR France	ML Mali
AU Australia	GA Gabon	MR Mauritania
BB Barbados	GB United Kingdom	MW Malawi
BE Belgium	HU Hungary	NL Netherlands
BG Bulgaria	IT Italy	NO Norway
BJ Benin	JP Japan	RO Romania
BR Brazil	KP Democratic People's Republic of Korea	SD Sudan
CF Central African Republic	KR Republic of Korea	SE Sweden
CG Congo	LI Liechtenstein	SN Senegal
CH Switzerland	LK Sri Lanka	SU Soviet Union
CM Cameroon	LU Luxembourg	TD Chad
DE Germany, Federal Republic of	MC Monaco	TG Togo
DK Denmark	MG Madagascar	US United States of America
FI Finland		

## CIRCULAR SLITTING KNIFE

## TECHNICAL FIELD

5 The present invention relates to a circular slitting knife, particularly a circular slitting knife, which is designed to slit relatively soft plain or composite materials, e.g. textile, paper, plastic materials or a combination of such materials. Said circular slitting knife  
10 is designed to work against a counter pressure cylinder, e.g. made of a plastic, a rubber or a comparable material.

## THE STATE OF THE ART

Swedish printed publication 394 091 relates to a slitting device having a circular rotating slitting knife. In this device two circular discs made of an elastic material are disposed on either side of the rotary slitting knife. The diameter of the discs of an elastic material is somewhat smaller than the diameter of the rotary slitting knife.  
20 Since the slitting is done in grooves and said circular discs of an elastic material run along the edges of the groove, the slitting edge is caused to run with a higher circumferential speed than if the edge would run against a firm support and provided the translational speed of  
25 the shaft of the slitting knife would be the same. This slitting device is at a disadvantage partly because it has to run in a groove and partly because it must be made comparatively thick, if hard materials, e.g. hard metals, are to be used.

30 German printed publication 3 446 161 relates to a slitting device having a circular slitting knife, which to a certain degree is laterally supported by means of, in relation to the slitting knife, partly elastically mounted and partly  
35 rigidly mounted elements. Said lateral supporting elements are designed partly to avoid a waved deformation of the

slitting knife and partly to brake the knife to some extent. This device is hardly suitable when thin discs made of e.g. a hard metal are to be used, since the lateral support is unsymmetrically distributed in relation to the 5 central skaft of the slitting knife.

Furthermore, USP 3 358 370, 4 086 835 and 3 293 962 relate to slitting devices having disc-shaped slitting knives or having knives designed as ring-shaped slitting 10 knives on slitting cylinders. These specifications relate to slitting devices, which are at a disadvantage either because the slitting knife must perform in a groove or is provided with slitting teeth. When the slitting is done in grooves, the grooves must be designed differently 15 for different materials to be slit and when the slitting is done by toothed slitting knives, the toothing ought to be matched with the material to be slit.

Generally when slitting textile materials by means of 20 slitting devices according to the above-mentioned specifications as well as generally when known slitting devices are used, as a rule a lot of fluff is obtained and consequently uneven edges having a faulty finish.

#### 25 A DESCRIPTION OF THE INVENTION

The object of the present invention is to provide an improved circular slitting knife of the kind described above. The improvement which we try to attain in the first place is to eliminate the disadvantages of known constructions. 30 The desired result is attained by designing the circular slitting knife in such a way, that it will include a thin circular slitting blade having an edge and on either side of this slitting edge rings or discs made of a rubber or a plastic material. Said rings or discs are pressed against 35 the slitting blade by means of clamping tools, such as outer metal plates or the like.

One of the characterizing features of the circular slitting knife according to the invention is the combination of the thin blade having an edge, the rings or plates made of a rubber or a plastic material as well as clamping tools such as outer metal plates or the like. Another characterizing feature is that said rubber rings or plates do not have to be fastened to the slitting blade by curing.

Generally said circular slitting knife can be used to slit 10 various composite soft materials, such as textile materials, paper materials, plastic materials etc. as well as various composite materials.

Additional characterizing features of the present invention and advantages of it will be set forth in the following description as well as in the following patent claims.

#### A BRIEF DESCRIPTION OF THE DRAWINGS

In the following description reference is made to the 20 accompanying drawings, in which:

Fig. 1 is a central longitudinal section along the rotational shaft of the circular slitting knife;

Fig. 1 B shows, scaled up, the deformation of the elastic 25 plates, when a slitting is done according to a preferred embodiment;

Fig. 1 A shows the same detail as in Fig. 1 B, when the circular slitting knife is removed from the holding-on cylinder and consequently is not slitting;

30 Fig. 2 shows details corresponding to the details shown in Fig. 1 A and 1 B, according to an additional preferred embodiment;

Fig. 3 is a perspective exploded view of the circular slitting knife and devices which support the circular slitting 35 knife; and

Fig. 4 shows a plurality of circular slitting knives, which

are mounted to simultaneously slit a passing web material into a plurality of narrow strips (tapes).

#### A DESCRIPTION OF PREFERRED EMBODIMENTS

5 The circular slitting knife comprises a circular blade 1 made of a hard metal or possibly of a metal having a hard metal edge and on either side of said blade a ring, 2 respectively 3, made of a rubber or a plastic material, e.g. polyurethane. Rubber rings 2,3 are clamped by outer metal 10 plates 4,5.

According to a first preferred embodiment, which is shown in Fig. 1 B; rings 2,3 taper towards the edge. The tips of rings 2,3 cover the edge of slitting blade 1 and consequently said edge can not be damaged or the operator cannot be hurt by the edge. During slitting rings 2,3 are pressed inwardly and somewhat outwardly and consequently the edge is set free as is shown in Fig. 1 B.

20 Also, since the rubber or plastic material which rings 2,3 are made of is pressed outwardly, the slit edge surfaces tend to separate. The embodiment shown in Fig. 1 is used e.g. to slit textile materials 14, such as fabrics and cloths.

25 Fig. 3 is an exploded view of the circular slitting knife according to Fig. 1. Outer metal plate 4 is provided with a tubular shaft having an inner thread. A screw 6 has a thread, which corresponds to said inner thread. By means 30 of screw 6 outer metal plates 4,5, slitting blade 1, rings 2,3 as well as two ball bearings 7A,7B belonging to said inner rings can be secured to each other, a unit bound together being obtained thereby. Outer metal plate 4 is provided with two holes 19A,19B, which allow plate 4 to 35 be fastened, when screw 6 is tightened. The ball bearings are mounted in a press arm 8, which by means of an eccentric-

ric 10, a counter spring, not shown in the figure, as well as arm 11 can be rotated in any direction about a shaft 20 and be fastened in two positions. Consequently, by switching arm 11 the circular slitting knife can be 5 pressed against a nylon cylinder 15 or be removed from cylinder 15.

Blade 1 has a thickness of just 0.3 mm and a diameter of 45 mm. The slitting is done against a holding-on cylinder 10 made of nylon in the embodiment shown in Fig. 1. The edge penetrates into the nylon cylinder just a few tenths of a millimeter.

Fig. 2 shows a modified embodiment, designed to slit a paper 14'. In this case rather thick paper materials or several 15 layers can be slit. As many as 15 sheets having a surface weight of 70 g/cm<sup>2</sup> have been slit successfully. In this case those portions of rubber rings 2,3, which taper towards the edge, have been removed.

20 Rings 2,3 in Fig. 1 may also be turned round, the sharp edges thereby being placed outwardly instead of contacting blade 1. In this embodiment the rubber rings assist in the rotation of the knife.

25 In all the embodiments rubber rings or plastic rings 2,3 assist in protecting thin blade 1 against breaking. In case rings 2,3 of a plastic or a rubber material are excluded or are replaced by metal rings, thin blade 1 is 30 broken after it has been used for a short period of time. The breaking probably is caused by strong vibrations, which are reduced by means of rings 2,3 or 2',3' in Fig. 2. To solely use metal plates does not solve the breaking problem, when e.g. thin hard metal discs are used.

35 When paper materials are slit according to Fig. 2, hol-

ding-on cylinder 15 is made of a hard polyurethane.

In the embodiment shown in the exploded view, Fig. 3, press arm 8 is mounted on an arm holder 9, which in its 5 turn is slidably mounted on a guide 16. Guide 16 is provided with a wedge control, which ensures, that arm holder 9 does not rotate about guide 16. Arm holder 9 can by means of a lock arm 13 be locked in any desired position on guide 16.

10

Fig. 4 shows how a plurality of circular slitting knives according to the invention can be used to slit a band-like web material into five parts. Web material 14 is pulled in the direction indicated by the arrow, while it is contacting holding-on cylinder 15.

A few embodiments and modifications thereof have been described above. Other modifications of the described embodiments than the ones stated above are possible without 20 deviating from the general principles of the present invention and without said modifications resulting in the modified device ending up beyond the scope of the patent claims as set forth on the following pages.

25

30

## PATENT CLAIMS

1. A circular slitting knife, designed to work against a holding-on cylinder (15) made of a plastic, a rubber or a composite material, in order to slit relatively soft materials, such as textile, paper, plastic or similar materials or combinations of such materials (14), characterized in that said circular slitting knife comprises a thin circular slitting blade (1) having an edge and on either side of this slitting blade rings or discs made of a rubber or a plastic material (2,3), which are pressed against said slitting blade by means of clamping devices, such as outer metal plates (4,5) or the like, that said rings or discs of a rubber or a plastic material roughly have the same outer diameter as the slitting blade, which means that they roughly cover the edge, and that said rings or discs at least not in their peripherical parts adhere to said slitting blade but rather are designed in such a way that they, when a slitting is done, can be forced out of the area of the edge and set it free.
2. A circular slitting knife according to claim 1, characterized in that said rings (2,3) have two plain surfaces, which are perpendicular to the rotational symmetry axis of said rings, as well as at least one cylindrical surface.
3. A circular slitting knife according to claim 2, characterized in that said two plain surfaces, which are perpendicular to said rotational symmetry axis of said rings (2,3), have different sizes.
4. A circular slitting knife according to claim 3, characterized in that said rings (2,3) have a conical envelope surface.

5. A circular slitting knife according to claim 4,  
characterized in that the largest diameter  
of said rings (2,3) corresponds to the diameter of said  
slitting knife (1) or is up to 0.1 mm larger than the  
5 same.

6. A circular slitting knife according to claim 5,  
characterized in that said elastic rings  
(2,3) are mounted on either side of said slitting blade  
10 (1) in such a way, that their largest plain surfaces are  
pressed against said slitting blade (1).

7. A circular slitting knife according to claim 6,  
characterized in that said elastic rings  
15 (2,3) are mounted on either side of said slitting blade  
(1) in such a way, that their smallest plain surfaces  
are pressed against said slitting blade (1).

8. A circular slitting knife according to any of the pre-  
20 ceding claims, characterized in that the  
clamp force, which is exerted by means of the clamping  
devices (4,5), is generated by at least one screw faste-  
ning (6,4), the axis of which coincides with the rotatio-  
nal axis of said circular slitting knife.  
25

9. A circular slitting knife according to any of the pre-  
ceding claims, characterized in that said  
slitting blade or at least its edge is made of a hard  
metal.  
30

10. A circular slitting knife according to any of the pre-  
ceding claims, characterized in that said  
slitting blade (1) has a thickness, which is not larger  
than 1 % of the diameter of the blade and preferably is  
35 within the interval 4-8 % of the diameter of the blade.

1/4

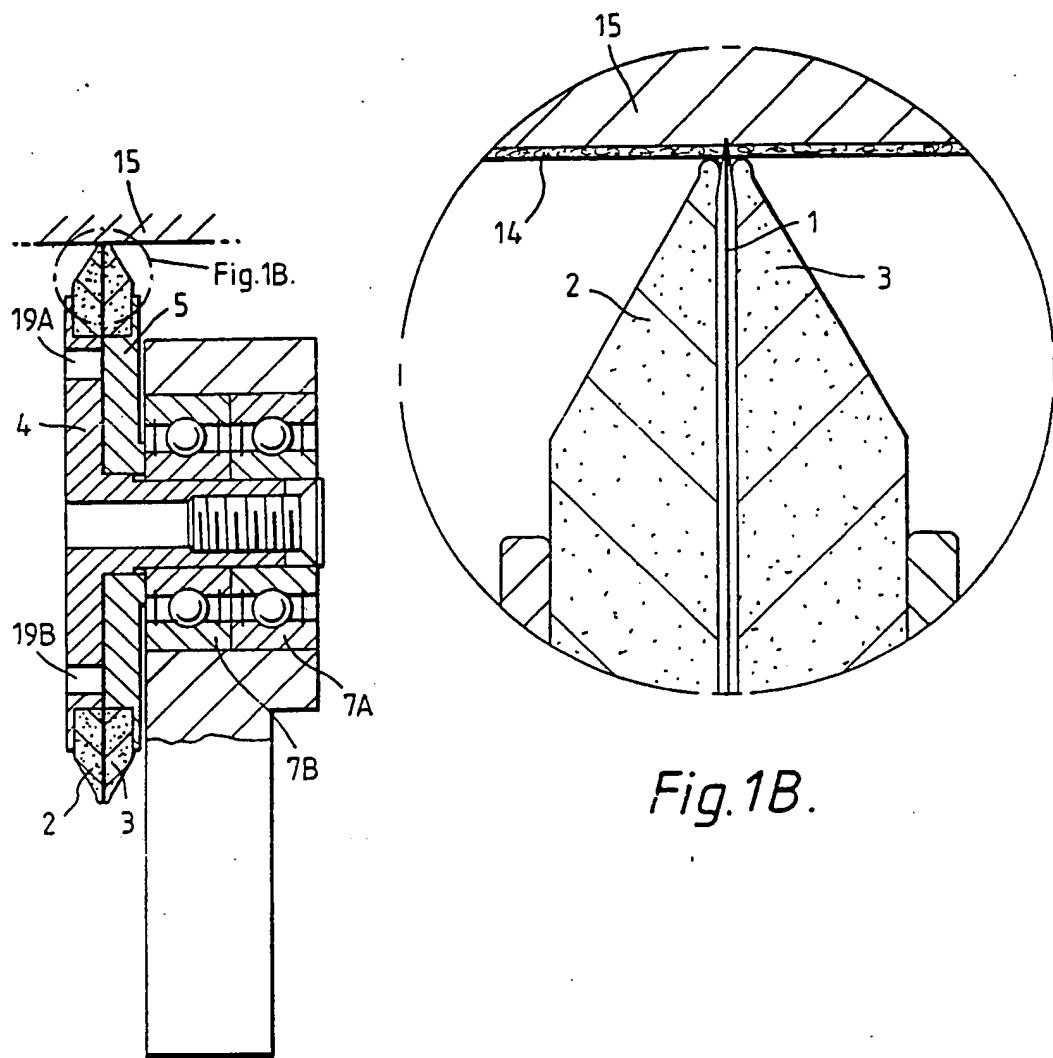


Fig. 1.

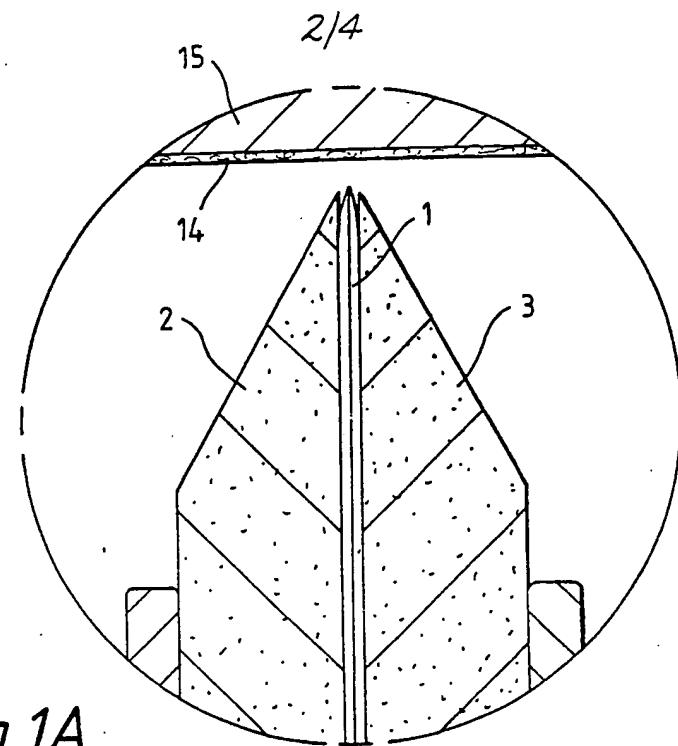


Fig. 1A.

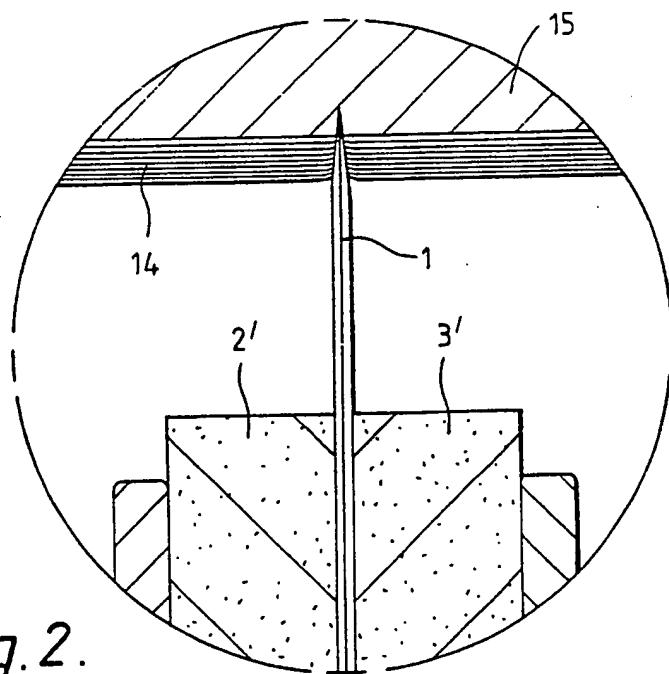
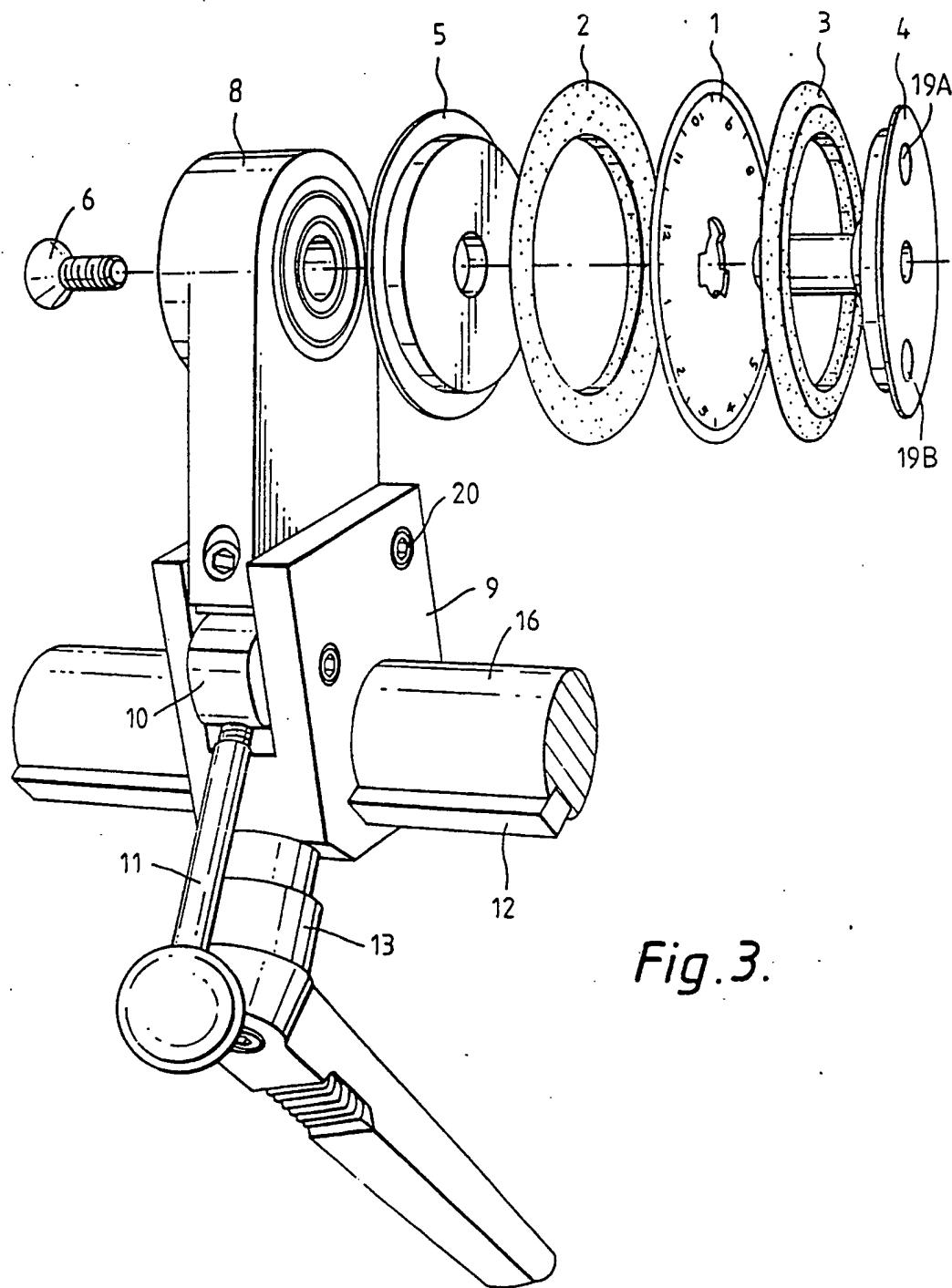


Fig. 2.

3/4



4/4

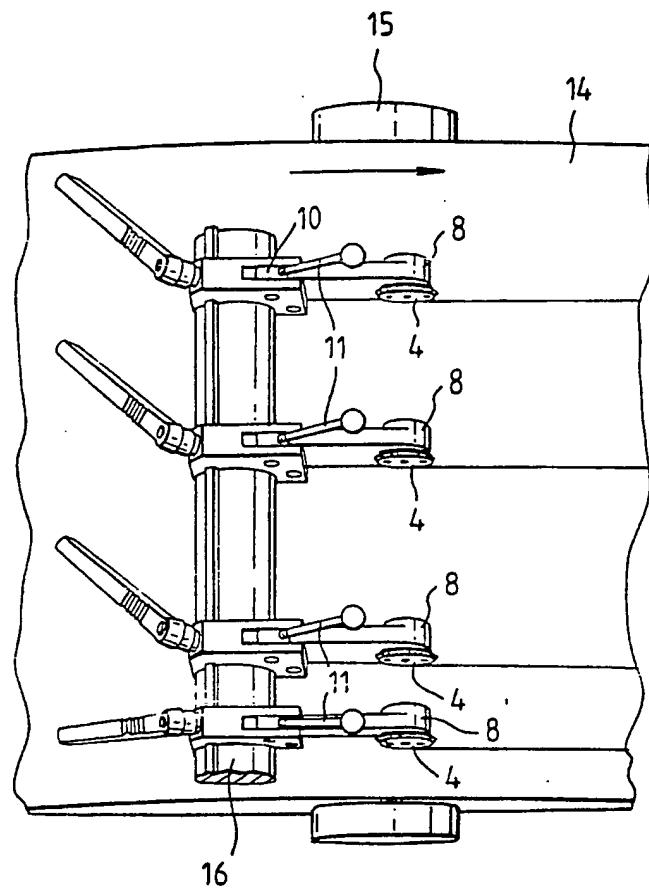


Fig. 4.

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/SE88/00594

## I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) \*

According to International Patent Classification (IPC) or to both National Classification and IPC 4

B 26 D 1/14

## II. FIELDS SEARCHED

Minimum Documentation Searched ?

Classification System	Classification Symbol
IPC 4	B 26 D 1/12-1/43; B 25 B 25/00; B 26 D 7/26
US C1	30:306, 307, 347; 83:56, 98, 331, 332, 348, 469, 471, 483, 484, 501-505

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched \*

SE, NO, DK, FI classes as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT \*

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages ***	Relevant to Claim No. ***
A	DE, A1, 3 446 161 (KAI CUTLERY CENTER CO, LTD, SEKI, GIFU ) 2 January 1986	1-10
A	SE, B, 394 091 (EKDAHLVERKEN AB) 6 June 1977	1-10
A	US, A, 3 293 962 (P. GIANARIS) 27 December 1966	1-10
A	US, A, 3 358 370 (R.W. LOGAN) 19 December 1967	1-10
A	US, A, 2 862 231 (W. VOIGT) 2 December 1958	1-10
A	US, A, 1 968 242 (G.B. BIRCH) 31 July 1934	1-10
A	US, A, 1 794 398 (J.A. CAMERON ET AL) 3 March 1931	1-10

\* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"Z" document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search

1989-02-09

Date of Mailing of this International Search Report

1989-02-14

International Searching Authority

Swedish Patent Office

Signature of Authorized Office

*Jöar Andréasson*  
Ivar Andréasson

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**